PROGRAMMABLE DIGITAL PANEL METER

N12P

SERVICE MANUAL

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PROGRAMMABLE DIGITAL PANEL METER N12P TYPE SERVICE MANUAL

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1. APPLICATION

N12P programmable digital panel meters are destined to measure a.c. voltages and a.c. currents, active, reactive and apparent power, power factor cosφ, ratio of the reactive power to the active power, tgφ, phase angle φ, frequency, active, reactive and apparent energy, 15 minutes' active power, 10 minutes' voltage, 10 seconds' frequency. Additionally, the meter enables the indication of the current time.

A 5 or 4-digit display field (digits of 14 or 20mm high) in red or green colour, ensures a good legibility at a long distance.

They realise other additional functions as:

- signalling of the set alarm value overrunning,
- signalling of the measuring range overrunning,
- automatic set-up of the decimal point,
- programming of the measurement repetition rate,
- programming of the averaging kind: arithmetic mean, stepping window,
- programming of the voltage and current ratio,
- programming of the alarm and analogue output with the reaction to an optional measured quantity, independently of currently displayed values,
- storage of maximal and minimal values of all input quantities,
- resetting of counters: active, reactive and apparent energy,
- synchronisation of 15 minutes' power, 10 minutes' voltage,
- monitoring of set parameter values,
- monitoring of all measuring quantities,
- blocking of the parameter introduction by means of a password,
- re-calculation of the measuring quantity into an optional quantity on the base of an individual, linear characteristic,
- servicing of the interface with a MODBUS protocol, both ASCII and RTU,
- conversion of the measured quantity into a standard programmable current or voltage signal,
- highlighting of any optional measuring unit as per the order,
- storage of counter states in memory.

The N12P meter enables the measurement of:

- True rms voltage ..... $U_{sk} = \sqrt{\frac{1}{n}\sum_{i=1}^{n} u_i^2}$
- 10 minutes' mean voltage ..... $U_{śr} = \frac{1}{n}\sum_{i=1}^{10} U_{sk_i}$
- True rms current ..... $I_{sk} = \sqrt{\frac{1}{n}\sum_{i=1}^{n} i_i^2}$
- Active power ..... $P = \frac{1}{n}\sum_{i=1}^{n} u_i \cdot i_i$
- Mean active power (0 to 3600 sec, e.g. 15 minutes) $P_{sr} = \frac{1}{n}\sum_{i=1}^{n} P_i$
- Active energy ..... $E_p = \frac{1}{n}\sum_{i=1}^{n} aP_i$
- Apparent power ..... $S = U_{sk} \cdot I_{sk}$
- Apparent energy ..... $E_S = \frac{1}{n}\sum_{i=1}^{n} aS_i$
- Reactive power ..... $Q = sign\left(\sqrt{S^2 - P^2}\right)$
- Reactive energy ..... $E_Q = \frac{1}{n}\sum_{i=1}^{n} aQ_i$
- Power factor ..... $\cos\varphi = \frac{P}{S}$
- Ratio of the reactive power to active power ..... $\mathrm{tg}\,\varphi = \frac{Q}{P}$
- Phase angle ..... $\varphi = sign\left(arc\cos\frac{P}{S}\right)$
- Voltage frequency ..... $f = \frac{1}{T}$

- mean 10 seconds' frequency ..... $f_{śr} = \frac{1}{n}\sum_{i=1}^{10} f_i$

External ratios of measuring current and voltage transformers are taken into consideration in measurements. The ratio is optionally programmed.

With the meter we deliver:
- a guarantee card,
- 4 holders to fix the meter on a panel,
- a service manual,
- a plug with screw connections or self-locking connections,
- a set of stickers with units.

When unpacking the meter, please check whether the type and execution code on the data plate correspond to the order.

Symbols located in this service manual mean:

- especially important, one must acquaint with this before connecting the meter. The non-observance of notices marked by these symbols can occasion the damage of the meter.

- one must take note of this when the meter is working inconsistently to the expectations

2. BASIC REQUIREMENTS, OPERATIONAL SAFETY

N12P meters are destined to be mounted into panels and cubicles. In the range of operational safety they are in conformity with the IEC 61010-1+A1:1996 standard requirements.

- The installation and meter connection should be operated by qualified personnel.
- One must take into consideration all accessible protection requirements.

- Before switching the instrument on, one must check the correctness of the network lead connection IEC 61010-1 p. 6.10. and p. 6.11.2.
- In case of the protection terminal connection with a separate lead one must remember to connect it before the connection of network leads.
- Do not connect the meter to the network through an autotransformer.
- Before taking the meter housing out one must turn the supply off.
- The removal of the meter housing during the guarantee contract period may cause its cancellation.

3. FITTING ⚠

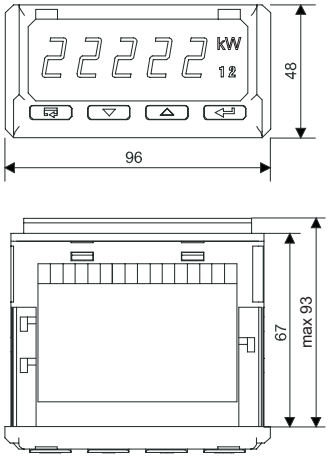


Fig. 1. Overall dimensions

Prepare a ($92^{+0.6}$ x $45^{+0.6}$) mm hole in the panel. The thickness of the material from which the panel is made can not exceed 15 mm. One should introduce the meter from the front of the panel when the supply circuit is turned off . After introducing the meter, fasten it by means of holders.

4. CONNECTION

At the rear side of the meter there is a terminal strip seat. A connector with screw terminals or a self-locking connector is added to the meter depending on the meter type chosed in the ordering code.

The fig. 2. shows the connection way of external signals. The description of the connector is also printed on the meter housing. In case of a meter working in an environment of high perturbances one should use external filters.

It is recommended to use screened leads on the meter input. As a feeder cable one must use a two-wire cable and choose the lead cross-section such that in case of a short-circuit from the device side, the protection of the cable was ensured by means of the electric installation fuse.

Requirements related to the feeder cable are regulated by the IEC 61010-1 p.6.10. standard.

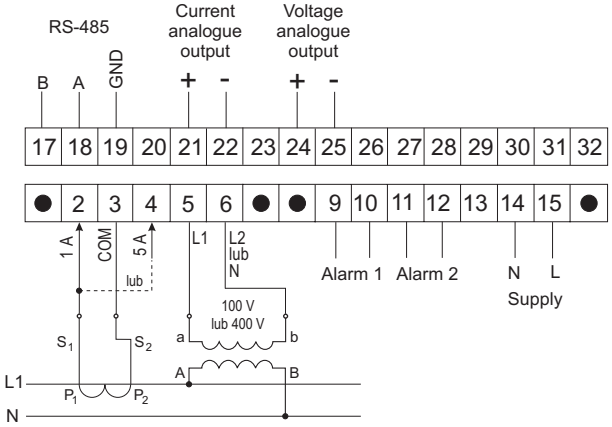


Fig. 2. Connection way of the N12P meter

5. OPERATION

After switching the meter on, its type and next the program version are displayed. After ca 10 sec., the meter transits automatically into the measuring mode and the input signal value is displayed.

The meter blanks automatically insignificant zeros. Values of the binary point and the multiplier in the measurement of voltage, current and power are automatically set up taking into consideration assigned ratios. The exceeding of the alarm threshold is signalled by means of alarm diodes 1 and 2.

The basic unit of the measured value is automatically highlighted by the meter [1)].

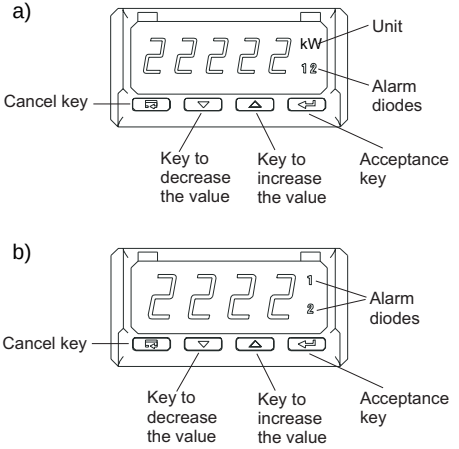


Fig. 3. Description of the meter faceplate
a) 5-digit execution
b) 4-digit execution

1) *No exists in the 4-digit (20 mm) execution.*

Key functions:

[↵] - **acceptance key**

- entry into the programming mode (hold down during ca 3 seconds),
- moving through the menu - choice of the level,
- moving through the monitoring menu of measured values - selection of the next value,
- entry into the change mode of the parameter value,
- acceptance of the changed parameter value.

[▲] - **key to increase the value**

- displaying of the maximal value,
- display of the maximal value - monitoring menu of measured parameters,
- entry to the parameter group level,
- moving through the chosen level,
- change of the chosen parameter value - increase of the value
- succeeding parameter in the monitoring mode

[▼] - **key to decrease the value**

- displaying of the minimal value,
- display of the minimal value - monitoring menu of measured parameters,
- entry to the parameter group level,
- moving through the chosen level,
- change of the chosen parameter value - decrease of the value
- succeeding parameter in the monitoring mode

[↩] - **cancel key**

- entry to the menu of parameter monitoring (hold down during ca 3 seconds),

- exit from the monitoring menu of meter parameters and measured values,,
- cancel of the parameter change,
- absolute exit from the programming mode

The pressure of the [▲] [↵] key combination and holding down during ca 3 sec. causes the erasing of alarm signalling. This operation exclusively acts when the support function is switched on.

The pressure of the [↩] [▼] key combination causes the erasing of all minimal value.

The pressure of the [↩] [▲] key combination causes the erasing of all maximal values.

The pressure and holding down of the [↵] key during ca 3 sec. causes the entry into the programming matrix. The programming matrix is secured by the safeguard code.

The pressure and holding down of the [↩] key during ca 3 sec. causes the entry into the monitoring menu. one must move through the monitoring menu by means of [▼] and [▲] keys. In this menu, all programmable meter parameters, except service parameters, are only accessible to the read-out. The exit from the monitoring menu takes place by means of the [↩] key. On the monitoring menu, parameter symbols are alternately displayed together with their values. The fig. 4. shows the operation algorithm of the meter. The pressure and holding down of [▼] and [▲] keys during ca 3 sec. causes the entry in to the monitoring menu of measured value. One must move through the monitoring menu by means of [↵], [▼] and [▲] keys. The pressure of the [↵] key causes the display of the successive symbol of the measured value alternately with the value and the multiplier of this value in one of the shape 10E0, 10E3, 10E6, 10E9.

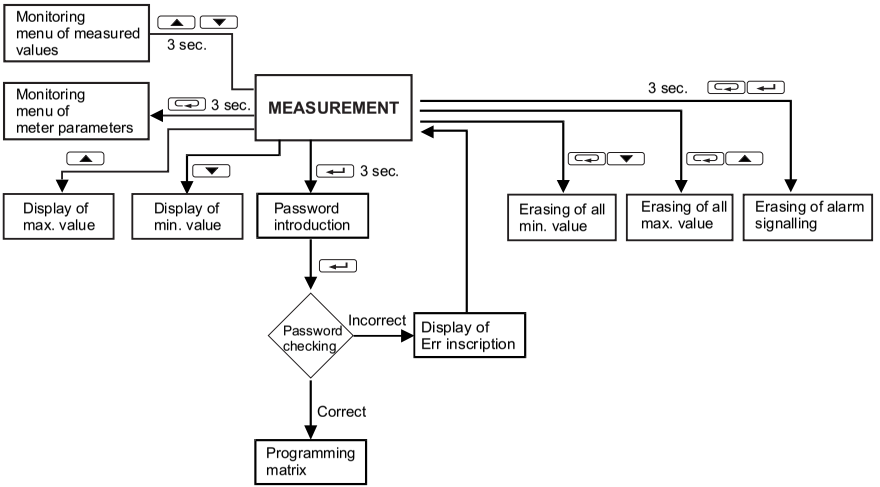


Fig. 4. Operation algorythm of the N12P meter

The pressure of the ▼ key causes the display of the minimal value of the currently displayed value, whereas the pressure of the ▲ key causes the display of the maximal value of the currently displayed value. The exit from the menu is proceeded by means of the ↩ key.

The appearance of the following symbols on the digital displays means:

Err - Incorrect introducing of the security code.

---- - Exceeding of the upper measuring range.

_ _ _ _ - Exceeding of the lower measuring range or lack of signal.

6. PROGRAMMING

The key ↵ pressure and its holding down during ca 3 seconds causes the display of the security code symbol **SEC** alternately with the **0** value set up by the manufacturer. The writing of the correct code causes the entry into the programming matrix. The transition matrix into the programming mode is shown on the fig. 5.

We choose the level by means of the ↵ key, whereas the entry and moving through parameters of the chosen level is carried out by means of the ▼ and ▲ keys. Parameter symbols are displayed alternately with their actual values.

In order to change the value, one must use the ↵ key. To resign of the parameter change one must press the ↩ key. To exit from the chosen level one must select the - - - symbol and press the ↵ key.

In order to exit from the programming matrix into measurement, one must press the [ESC] key.

The inscription **HEY** occurs and after ca 5 sec. the meter will automatically enter into the measurement of the input quantity.

Way of changing the value of the chosen parameter

In order to increase the value of the chosen parameter one must press the [▲] key. A single pressure of this key causes a value increase of 1. The hold of the pressed [▲] key causes a continuous increase of the value up to display the **0** value.

The jump to the next digit follows after this value . The further change is similar. The key release in any moment causes a jump to the first digit. It is similarly in case of the value decrease.

The single pressure of the [▼] key causes a value decrease of one. The hold of the [▼] key pressure causes a continuous decrease of the value till the display of 0. The jump to the next digit follows after this value. The further change is similar. In any moment, the key release causes a jump on the first digit.

In order to accept the set up parameter one must press the [↵] key. Then, the writing of the parameter and display of its symbol follow alternately with the new value. The pressure of the [ESC] key during the change of the parameter causes the resignation of the writing.

Pos. no.														
1	**InP** Input param.	**tYP** Type of displayed quantity	**RAnU** Voltage input range	**RAnI** Current input range	**trU** Voltage transformer ratio	**trI** Current transformer ratio	**Aur** Kind of averaging	**UAL** Number of measurem.	**Ind** Linear charact.	**H1** (1)	**Y1** (1)	**H2** (1)	**Y2** (1)	**d_P** Decimal point (1)	...
2	**ALr1** Alarm 1	**P_A1** Kind of input quantity for alarm 1	**PrL1** Lower threshold	**PrH1** Upper threshold	**tYP1** Alarm type	**dLY1** Alarm delay	**LEd1** Signal support	...							
3	**ALr2** Alarm 2	**P_A2** Kind of input quantity for alarm 2	**PrL2** Lower threshold	**PrH2** Upper threshold	**tYP2** Alarm type	**dLY2** Alarm delay	**LEd2** Signal support	...							
4	**Out** Output	**P_An** Kind of input for analogue output	**tYPA** Kind of output (Volt/curr)	**AnL** Lower output	**AnH** Upper output threshold	**bAud** Transmision baud rate	**trYb** kind of transm.	**Adr** Device address	...						
5	**SEr** Service	**SEt** Writing of standard parameters	**SEC** Password introd.	**tSt** Display test	**Hour** Hour setting	**JEd** Unit highlight	**CEnP** resetting of active energy counter	**CEnq** resetting of reactive energy counter	**CEnS** resetting of appar. energy counter	**CPau** synchr. of 15 min power	**Cuau** synchr. of 10 min voltage	...			

(1) - *exists only, when the individual characteristic is included* (**Ind = On**)
(2) - *exists only in executions with 5 displayed digits*

Fig. 5. Transition matrix into the programming mode

Table 1

Parameter symbol	Description	Range of changes
tYP	Selection of the measured value	**U** - rms voltage **I** - rms current **FrEq** - frequency **P** - active power **q** - reactive power **S** - apparent power **PF** - power factor **tF** - ratio of reactive power to active power **FI** - angle phase **EnP** - active energy **Enq** - reactive energy **EnS** - apparent energy **P_Au** - 15 minutes' mean active power **U_Au** - 10 minutes' mean voltage **F_ Au** - 10 seconds' mean frequency **Hour** - current time
RanU	Selection of voltage range.	100U - 100 V range 400U - 400 V range
RanI	Selection of current range	1A - 1 A range 5A - 5 A range
trU	Selection of voltage ratio	In 4-digit execution: **0...9999** In 5-digit execution: **0...99999**
trI	Selection of current ratio	In 4-digit execution: **0...9999** In 5-digit execution: **0...99999**
Aur	Selection of the averaging mode	**Cnt** - Arythmetic mean **CntS** - Stepping window

table 1 (continuation)

UAL	Number of averaged measurements. The time of a single measurement is equal 500 ms. The result on the display is refreshed every **UAL** x 500 ms.	In 4-digit execution: **0...9999** In 5-digit execution: **0...99999** The writing of the 0 causes the measurement switching off and the blanking of displays.
Ind	Switching off or on of the user's individual linear characteristic	**ON** - Characteristic switched on **OFF** - Characteristic switched off
H1, Y1 **H2, Y2**	Parameters of the individual characteristic. On the base of co-ordinates of two points given by the user, the meter assigns coefficients of the individual characteristic a and b **Y= aH+b.** **H1** and **H2** - measured value **Y1** and **Y2** - expected value on the display	In 4-digit execution: **-1999...9999** In 5-digit execution: **-19999...99999**
D_P	Setting of the decimal point. This setting acts when the individual characteristic is switched on. When the characteristic is switched off the decimal point is set automatically.	Setting possibilities in the 4-digit execution: **0000** **000.0** **00.00** **0.000** In the 5-digit execution: **00000** **0000.0** **000.00** **0.0000**
P_A1 **P_A2**	Kind of input quantity type at which the alarm is to react	**U** - rms voltage **I** - rms current **FrEq** - frequency **P** - active power **q** - reactive power **S** - apparent power **PF** - power factor, cosφ

		tF - ratio of reactive power to active power, tgφ **FI** - angle phase, φ **EnP** - active energy **Enq** - reactive energy **EnS** - apparent energy **P_Au** - 15 minutes' mean active power **U_Au** - 10 minutes' mean voltage **F_ Au** - 10 seconds' mean Frequency
PrL1 **PrL2**	Alarm lower threshold	In 4-digit execution: **-1999...9999** In 5-digit execution: **-19999...99999**
tYP1 **tYP2**	Alarm type The fig. 6. shows the graphical illustration of alarm types	**nor**-normal **On** - switched on **OFF** - switched off **H_On** - manually switched on, till the time of the alarm type change, the alarm output is switched on for good. **H_OF** - manually switched off, till the time of the alarm type change, the alarm output is switched off for good.
dLY1 **dLY2**	Delay of the alarm operation. The parameter is defined in number of measurements, i. e. that one should give after how many measurement will be to operate the alarm. The alarm switching off follows without delay. The parameter takes in account the number of averaged measurements **UAL**, i.e. the whole averaging cycle is treated as a single measurement.	In 4-digit execution: **0...9999** In 5-digit execution: **0...99999** The introduction of 0 causes the operation at the moment of alarm appearance.

LEd1 **LEd2**	Support of the alarm signalling. In the situation when the function of support is switched on after the withdrawal of the alarm state, the signalling diode is not blanked. The function signals the alarm state till the moment of its blanking by means of the combination of [ESC] and [↵] keys. This function only and exclusively concerns the alarm signalling and the relay contacts will act without support, according the chosen alarm type.	**On** - support switched on **OFF** - support switched off
P_An	Kind of the input quantity type on which the analogue output is to react.	**U** - rms voltage **I** - rms current **FrEq** - frequency **P** - active power **q** - reactive power **S** - apparent power **PF** - power factor **tF** - ratio of reactive power to active power **FI** - angle phase **EnP** - active energy **Enq** - reactive energy **EnS** - apparent energy **P_Au** - 15 minutes' mean active power **U_Au** - 10 minutes' mean voltage **F_ Au** - 10 seconds' mean frequency
tyPA	Type of analogue output	**PrAd** - current **nAP** - voltage
AnL	Lower threshold of the analogue output. It is the parameter defining the value on the display for which we want obtain 0 on the analogue output.	In 4-digit execution: **-1999...9999** In 5-digit execution: **-19999...99999**

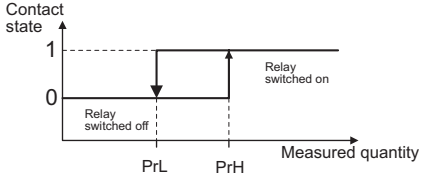
table 1 (continuation)

AnH	Upper threshold of the analogue output. It is the parameter defining the value on the display for which we want obtain the max. value (20 mA or 10 V) on the analogue output.	In 4-digit execution: **-1999...9999** In 5-digit execution: **-19999...99999**
bAud	Baud rate of the RS-485 interface	**2400** - 2400 bit/s **4800** - 4800 bit/s **9600** - 9600 bit/s
trYb	Kind of transmission through the RS-485 interface.	**OFF** - interface off **A8n1** - ASCII 8N1 **A7E1** - ASCII 7E1 **A7o1** - ASCII 7O1 **r8n2** - RTU 8N2 **r8E1** - RTU 8E1 **r8o1** - RTU 8O1
Adr	Device address	**0... 247**
SEt	Writing down of manufacturer´s settings. Parameter values set up by the manufacturer are shown in the table 2.	A pressure of the [↵] key causes the writing down of standard parameters into the meter. The execution of this operation is signalled by the inscription **End.**
SEC	Introduction of a new password	In 4-digit execution: **-1999...9999** In 5-digit execution: **-19999...99999**
tSt	Display test. The test consists on the consecutive switching of digital display segments on. Alarm diodes and highlighted diodes of the unit, should be lightend.	The pressure of the key causes the [↵] test switching on. The [↩] ends the test.

table 1 (continuation)

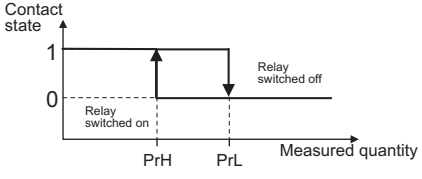
Hour	Setup of the current time	**0.00...23.59** The introduction of an incorrect hour will cause its writing into the memory, but after the exit from the matrix the meter will make the correction of the error, i.e. the introduction of the 0.70 hour will cause that the meter will treat that as minutes and set up 1.10.
JEd	Unit highlighting switching on.	**On** - highlighting switched on **OFF** - highlighting switched off
CEnP	Resetting of the active power counter.	The pressure of the key will cause the resetting of the active power counter.
CEnq	Resetting of the reactive power counter.	The pressure of the key will cause the resetting of the reactive power counter.
CEnS	Resetting of the apparent power counter.	The pressure of the key will cause the resetting of the apparent power counter.
CPAu	Synchronisation of the 15 minutes' mean active power.	The pressure of the key will cause the measurement start of the 15 minutes' mean active power.
CUAu	Synchronisation of the 10 minutes' mean voltage.	The pressure of the key will cause the measurement start of the 10 minutes' mean voltage.
_ _ _ _	Exit of the parameter group from the chosen level.	The pressure of the key causes the exit of the parameter group from the chosen level.

a) **nor**



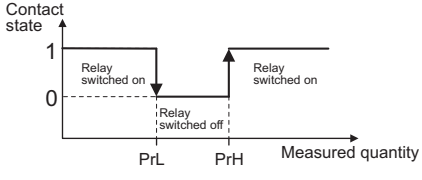
PrH > PrL

b) **nor**



PrH < PrL

c) **OFF**



d) **On**

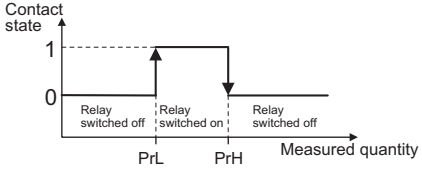


Fig. 6. Alarm type
a), b) normal, c) switched off , d) switched on

CAUTION !

- In case of **On** and **OFF** alarm types, the writing down of **PrL>PrH** will cause an automatic transcription of the value from the threshold **PrL** into **PrH** and from threshold **PrH** into **PrL**. The alarm type will not change.
- In case of a measuring range exceeding the relay reaction is concordant with written down **PrL**, **PrH** and **tYP** parameters. In spite of displaying the exceeding, the meter will carry out the measurement as before.
- In case of an individual characteristic switching on (**Ind=On**) the measurement result is transformed linearly in accordance with introduced **H1**, **Y1**, **H2**, **Y2** parameters. The linear characteristic does not operate in case of selection as an input type of the current time.
- The meter currently checks up the value of the actually introduced parameter. In case when the introduced value overruns the upper range of changes given in the table 1, the meter will automatically carry out the change into the minimal value. Similarly, in case when the introduced value overruns the lower range of changes given in the table 1, the meter will automatically carry out the change into the maximal value.

Standard parameters of the meter Table 2

Parameter symbol	Level in the matrix	Standard value
tYP	1	P
RAnU	1	400U
RAnI	1	5A
trU	1	1
trI	1	1
Aur	1	Cnt
UAL	1	2
Ind	1	OFF
H1,Y1,H2,Y2	1	0
d_P	1	1
P_A1	2	U
P_A2	3	I
PrL1	2	0
PrH1	2	400.0
PrL2	3	0.000
PrH2	3	5.000
tYP1,tYP2	2,3	OFF
dLY1,dLY2	2,3	0
LEd1,LEd2	2,3	OFF
P_An	4	I
tYPA	4	PrAd
AnL	4	0
AnH	4	5.000
bAud	4	9600
trYb	4	r8n2
Adr	4	1
SEC	5	0
Hour	5	0.00
JEd	5	On

7. RS-485 INTERFACE

N12 programmable digital meter series have their serial link in the RS-485 standard to communicate in computer systems and with other devices fulfilling the Master function. The MODBUS asynchronous character communication protocol has been implemented on the serial link. The transmission protocol describes the ways of information exchange between devices through the serial link.

7.1. Connection way of the serial interface

The RS-485 standard enables the direct connection to 32 devices on a single serial link of 1200 m long.

For the connection of a greater quantity of devices it is necessary to apply additional intermediate-separating systems.

The lead out of the interface line is given in the meter service manual. To obtain a correct transmission it is necessary to connect lines **A** and **B** in parallel with their equivalents in other devices.

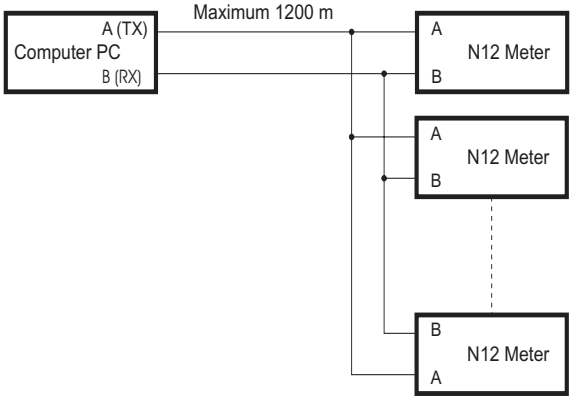


Fig. 7. Way of the RS-485 interface connection

The connection must be carried out with a screened lead. The screen must be connected to the protective grounding in a single point. The **GND** line serves to an additional protection of the interface line for long connections.
One must connect it to the protective grounding (this is not necessary for the interface correct work).
In order to obtain the connection with an IBM PC computer, an RS-485 interface card or a RS-232/RS-485 converter is indispensable.

On the Fig. 7. the device connection is shown.

The marking of the transmission line for the card in the PC computer depends on the card producer.

7.2. Description of the MODBUS protocol implementation

The implemented protocol is compatible with the PI-MBUS-300 Rev G Modicon Company.
Setting-up of meter serial link parameters in the MODBUS protocol:

- meter address 1...247
- baud rate 2400, 4800, 9600 bps
- working modes ASCII, RTU
- information unit ASCII: 8N1, 7E1, 7O1
  RTU: 8N2, 8E1, 8O1
- maximal response time 300 ms

The parameter configuration of the serial link is described in the further parts of this service manual. It consists on the settlement of the baud rates (**bAud** parameter), device address (**Adr** parameter) and the information unit type (**trYb** parameter).

Notice:

Each meter connected to the communication network must have:
- a unique address, different from addresses of other devices connected in the network,
- an identical baud rate and information type.

7.3. Description of used functions

Following functions of the MODBUS protocol have been implemented in meters of N12 series:

Description of functions Table 3

Code	Meaning
03	Reading of n-registers
06	Writing of a single register
16	Writing of n-registers
17	Identification of the slave device

Notice:
In meters of N12 series the response frame to the function 17 looks as follows:

Device address	Function	Number of bytes	Device identifier	Device state	Field depending on the device type	Control total
X	11	08	X	FF	XXXXXX	

Device address - depending on the set value
Function - function No: 0x11;
Number of bytes - 0x08;
Device identifier
- 0x60 - N12S
- 0x61 - N12H
- 0x62 - N12T
- 0x63 - N12O
- 0x64 - N12P
- 0x65 - N12B

Device state - 0xFF;
Field depending on the device type - XXXXXX

Device name - transmitted as ASCII characters and defines the meter type
S - 0x53, 53 X X X X X
H - 0x48, 48 X X X X X
T - 0x54, 54 X X X X X
O - 0x4F, 4F X X X X X
P - 0x50, 50 X X X X X
B - 0x42, 42 X X X X X

Number of displays - Field depending on the number of meter displays
- 0x04 - 4-digit meters, X 04 X X X X
- 0x05 - 5-digit meters, X 05 X X X X

Nr of the programming version - programming version implemented in the meter X X _ _ _ _ - 4-byte variable of float type

Control total - 2 bytes in the case of work in the RTU mode 1 byte in the case of work in the ASCII code
- 1 byte in case of work in the ASCII code

Example:

Work in the **RTU** mode, e.g.: **trYb=r8n2** (value 0x02 in the case of reading/writing through the interface).

N12P meter
Execution with a **4**- digit display,
Nr of the programming version **1.00**,
Device address set on **Adr=0x01**,

For this type of meter the frame will have the following shape:

Device address	Function	Number of bytes	Device identifier	Device state	Field depending on the device type	Control total (CRC)
X	11	08	64	FF	50 04 3F 80 00 00	CD 30

7.4. Register map of N12 meter

Register map of the N12 series meter Table 4.

Address range	Value type	Description
7000-7200	float (32 bits)	The value is placed in two succesive 16 bit registers. Registers include the same data as 32-bit registers from the 7500 area. Registers are only for read-out.
7200-7400	float (32 bits)	The value is placed in two succesive 16 bit registers. Registers include the same data as 32-bit registers from the 7600 area. Registers can be read out and written in.
7500-7600	float (32 bits)	The value is placed in a 32-bit register. Registers are only for read out.
7600-7700	float (32 bits)	The value is placed in a 32-bit register. Registers can be read-out and written in.

7.5. REGISTERS FOR WRITING AND READ-OUT

N12P meters **Table 5.**

The value is placed in two successive 16-bit registers. Registers include the same data as 32-bit register from the 7600 area.	The value is placed in 32-bit registers	Symbol	writing(w)/ read-out(r)	Range	Description	
7200	7600	**Identifier**	r	–	**Device identifier**	
					Value	
					60 xx	Identifier
					xx 04	4-digits execution
					xx 05	5-digits execution

Table 5 (continuation)

7202	7601	**tYP**	w/r	0... 15	**Input type**	
					Value	
					0	Rms voltage
					1	Rms current
					2	Frequency
					3	Active power
					4	Reactive power
					5	Apparent power
					6	Power factor
					7	Ratio of reactive power to active power
					8	Phase angle
					9	Active energy
					10	Reactive energy
					11	Apparent energy
					12	15 minutes' mean active power
					13	10 minutes' mean voltage
					14	10 seconds' mean frequency
					15	current time
7204	7602	**RanU**	w/r	0...1	**Voltage input range**	
					Value	
					0	100 V range
					1	400 V range
7206	7603	**RanI**	w/r	0...1	**Current input range**	
					Value	
					0	1 A range
					1	5 A range
7208	7604	**trU**	w/r	0...99999	**Voltage ratio**	
					Value	
					0...9999	4-digit meters
					0...99999	5-digit meters
7210	7605	**trI**	w/r	0...99999	**Current ratio**	
					Value	
					0...9999	4-digit meters
					0...99999	5-digit meters

Table 5 (continuation)

7212	7606	**Aur**	w/r	0... 1	**Kind of averaging**	
					Value	
					0	Arithmetical mean
					1	Stepping window
7214	7607	**UAL**	w/r	0... 99999	**Number of measurements**	
					Value	
					0... 9999	4-digit meters
					0... 99999	5-digit meters
7216	7608	**Con**	No occurs[1)]			
7218	7609	**SCAL**	No occurs[1)]			
7220	7610	**ConS**	No occurs[1)]			
7222	7611	**E_In**	No occurs[1)]			
7224	7612	**Auto**	No occurs[1)]			
7226	7613	**d_P**	w/r	0... 4	**Decimal point**	
					Value	
					0... 3	4-digit meters
					0... 4	5-digit meters
7228	7614	**Cnt**	No occurs[1)]			
7230	7615	**Ind**	w/r	0... 1	**Indivigual characteristic**	
					Value	
					0	Characteristic switched off
					1	Characteristic switched on
7232	7616	**H1**	w/r	-1999... 19999	**Parameter of the individual characteristic**	
					Value	
					-1999...9999	4-digit meters
					-19999...99999	5-digit meters
					Number of decimal places	Kind of input
					automatically set up	Rms voltage
					automatically set up	Rms current
					0.00	Frequency
					automatically set up	Powers

Table 5 (continuation)

					0.00 Energies 0.000 Power factor 0.0 Ratio of reaktive power to active power 0.0 Phase angle automatically set up 15 minutes'mean active power 0.0 10 minutes'mean voltage 0.00 10 seconds'mean frequency - Current time The range of **H1** and **H2** parameters depends on the max. range of the input signal. The writing of the value with a greater number of significant places after the decimal point will cause its round-off. Values beyond the range cause the return of the error code 03 (not allowed data value).
7234	7617	**Y1**	w/r	-19999... 99999	**Parameter of the individual characteristic** **Value** 0... 9999 4-digit meters 0... 99999 5-digit meters The **Y1**, **Y2**, **PrL1**, **PrH1**, **PrL2**, **PrH2**, **AnL**, **AnH** parameter range after switching the characteristic on, depends only on the set decimal point **d_P**. The writing of the value with a greater number of significant places after the decimal point will cause its round-off. Values beyond the range cause the return of the error code 03 (not allowed data value).
7236	7618	**H2**	w/r	-19999... 99999	**Parameter of the individual characteristic** Change range as for the **H1** parameter
7238	7619	**Y2**	w/r	-19999... 99999	**Parameter of the individual characteristic** Change range as for the **Y1** parameter

Table 5 (continuation)

7240	7620	**P_A1**	w/r	0...14	Kind of quantity type on which the alarm 1 is to react	
					Value	
					0	Rms voltage
					1	Rms current
					2	Frequency
					3	Active power
					4	Reactive power
					5	Apparent power
					6	Power factor
					7	Ratio of reactive power to active power
					8	Phase angle
					9	Active energy
					10	Reactive energy
					11	Apparent energy
					12	15 minutes' mean active power
					13	10 minutes' mean voltage
					14	10 seconds' mean frequency
7242	7621	**PrL1**	w/r	-19999...99999	**Lower threshold of alarm 1**	
					Value	
					-1999... 9999	4-digit meters
					-19999... 99999	5-digit meters
					For **Ind=0** -"OFF" When the individual characteristic is switched out the range change will be as for the parameter **H1**	
					For **Ind=0** - „ON" When the individual characteristic is switched on the range change will be as for the parameter **Y1**	
7244	7622	**PrH1**	w/r	-19999...99999	**Upper threshold of alarm 1**	
					Change range as for the **PrL1** parameter	
7246	7623	**tYP1**	w/r	0... 4	**Type of alarm 1**	
					Value	
					0	Normal
					1	Switched on
					2	Switched off
					1	Switched on manually
					1	Switched off manually

Table 5 (continuation)

7248	7624	**dLY1**	w/r	0... 99999	**Delay of alarm 1**	
					Value	
					0... 9999	4-digit meters
					0... 99999	5-digit meters
7250	7625	**LEd1**	w/r	0... 1	**Support of alarm1 signalling**	
					Value	
					0	support switched off
					1	support switched on
7252	7626	**P_A2**	w/r	0...14	Kind of quantity type on which the alarm 1 is to react	
					Value	
					0	Rms voltage
					1	Rms current
					2	Frequency
					3	Active power
					4	Reactive power
					5	Apparent power
					6	Power factor
					7	Ratio of reactive power to active power
					8	Phase angle
					9	Active energy
					10	Reactive energy
					11	Apparent energy
					12	15 minutes' mean active power
					13	10 minutes' mean voltage
					14	10 seconds' mean frequency
7254	7627	**PrL2**	w/r	-19999...99999	**Lover threshold of the alarm 2**	
					Change range as for the **PrL1** parameter	
7256	7628	**PrH2**	w/r	-19999...99999	**Lover threshold of the alarm 2**	
					Change range as for the **PrL1** parameter	

Table 5 (continuation)

7258	7629	**tYP2**	w/r	0... 4	**Type of alarm 2**	
					Value	
					0	Normal
					1	Switched on
					2	Switched off
					3	Switched on manually
					4	Switched off manually
7260	7630	**dLY2**	w/r	0... 99999	**Delay of alarm 2**	
					Value	
					0... 9999	4-digit meters
					0... 99999	5-digit meters
7262	7631	**LEd2**	w/r	0... 1	**Support of alarm2 signalling**	
					Value	
					0	support switched off
					1	support switched on
7264	7632	**TYPO**	No occurs[1)]			
7266	7633	**ConO**	No occurs[1)]			
7268	7634	**P_an**	w/r	0...14	Kind of quantity type on which the analogue output will be to react	
					Value	
					0	Rms voltage
					1	Rms current
					2	Frequency
					3	Active power
					4	Reactive power
					5	Apparent power
					6	Power factor
					7	Ratio of reactive power to active power
					8	Phase angle
					9	Active energy
					10	Reactive energy
					11	Apparent energy
					12	15 minutes' mean active power
					13	10 minutes' mean voltage
					14	10 seconds' mean frequency

Table 5 (continuation)

7270	7635	**TYPA**	w/r	0... 1	**Type of analogue output**
					Value
					0 current
					1 voltage
7272	7636	**AnL**	w/r	-19999...99999	**Lover threshold of the analogue output**
					Change range as for the **PrL1** parameter
7274	7637	**AnH**	w/r	-19999...99999	**Upper threshold of the analogue output**
					Change range as for the **PrL1** parameter
7276	7638	**Hour**	w/r	0...99999	**Current time**
					This parameter occurs with two places after the decimal point in the gg.mm format, where: gg - means hours mm - means minutes In case of the minute introduction with a value greater than 0.59 (e.g. 0.70), the meter will carry out the correction and write the value 1.10. In case of the hour introduction with a value greater than 23 (e.g. 27), the meter will carry out the correction of the error and write the value 3.00
7278	7639	**JEd**	w/r	0... 1	**Switching on of switching off of the unit highlighting**
					Value
					0 Highlighting switched off
					1 Highlighting switched on
					occurs only in 5-digit meters
7280	7640	**Del_min**	w/r	0... 1	**Erasing of the minimal value**
					Value
					0 lack of operation
					1 Erasing of the minimal value
7282	7641	**Del_maks**	w/r	0... 1	**Erasing of the maximal value**
					Value
					0 lack of operation
					1 Erasing of the maximal value
7284	7642	**Start/stop/ resetting**	No occurs[1)]		

Table 5 (continuation)

7286	7643	**CEnP**	w	0... 1	**Resetting of the active energy counter**	
					Value	
					0	lack of operation
					1	Resetting of the active energy counter
7288	7644	**CEnq**	w	0... 1	**Resetting of the active energy counter**	
					Value	
					0	lack of operation
					1	Resetting of the reactive energy counter
7290	7645	**CEnS**	w	0... 1	**Resetting of the apparent energy counter**	
					Value	
					0	lack of operation
					1	Resetting of the apparent energy counter
7292	7646	**CPAu**	w	0... 1	**Synchronization of the 15 minutes'mean power**	
					Value	
					0	lack of operation
					1	start of the synchronization of the 15 minutes'mean power
7294	7647	**CUAu**	w	0... 1	**Synchronization of the 10 minutes'mean voltage**	
					Value	
					0	lack of operation
					1	start of the synchronization of the 10 minutes'mean voltage

[1] *In case of registers no occurring in the given series of meters, their value is equal 1E+20*

7.6. Registers only to read-out

The value is placed in two successive 16-bit registers. Registers include the same data as 32-bit register from the 7500 area.	The value is placed in 32-bit registers	Name	Writing (w) Read-out (r)	Unit	Name of the quantity
1	2	3	4	5	6
7000	7500	Identifier	r	-	Constant identifying the device. 0 x 64 - N12P
7002	7501	Status	r	-	Status is the register describing the current state of the meter.
7004	7502	Steering	r	%	It is the register describing the steering of the analogue output.
7006	7503	Minimum	r	-	Minimal value of the currently displayed value.
7008	7504	Maximum	r	-	Maximal value of the currently displayed value.
7010	7505	Displayed value	r	-	Currently displayed value
7012	7506	No occurs[1)]			
7014	7507	No occurs[1)]			
7016	7508	No occurs[1)]			
7018	7509	U	r	V	Rms voltage
7020	7510	I	r	A	Rms current
7022	7511	P	r	W	Active power
7024	7512	Q	r	VAr	Reactive power
7026	7513	S	r	VA	Apparent power
7028	7514	PF	r	-	Power factor
7030	7515	tF	r	-	Rato of reactive power to active power
7032	7516	Fi	r	°	Angle phase
7034	7517	Freq	r	Hz	Frequency
7036	7518	E_nP	r	Wh	Active energy
7038	7519	E_nQ	r	VArh	Reactive energy
7040	7520	E_nS	r	VAh	Apparent energy

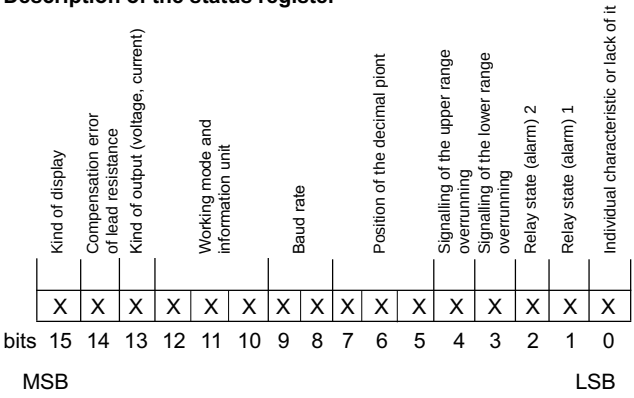
1	2	3	4	5	6
7042	7521	P_Au	r	W	15 minutes'mean active power
7044	7522	U_Au	r	V	10 minutes'mean voltage
7046	7523	F_Au	r	Hz	10 seconds'mean frequency
7048	7524	Hour	r	gg.mmss	Current time
7050	7525	U_min	r	V	Minimal value of rms voltage
7052	7526	U_max	r	V	Maximal value of rms voltage
7054	7527	I_min	r	A	Minimal value of rms current
7056	7528	I_max	r	A	Maximal value of rms current
7058	7529	P_min	r	W	Minimal value of active power
7060	7530	P_max	r	W	Maximal value of active power
7062	7531	Q_min	r	VAr	Minimal value of reactive power
7064	7532	Q_max	r	VAr	Maximal value of reactive power
7066	7533	S_min	r	VA	Minimal value of the apparent power
7068	7534	S_max	r	VA	Maximal value of the apparent power
7070	7535	PF_min	r	-	Minimal value of the power factor
7072	7536	PF_max	r	-	Maximal value of the power factor
7074	7537	tF_min	r	-	Minimal value of the ratio of the reactive power to the active power
7076	7538	tF_max	r	-	Maximal value of the ratio of the reactive power to the active power
7078	7539	Fi_min	r	°	Minimal value of the phase angle
7080	7540	Fi_max	r	°	Maximal value of the phase angle
7082	7541	Freq_min	r	Hz	Minimal value of the frequency
7084	7542	Freq_max	r	Hz	Maximal value of the frequency
7086	7543	P_An_min	r	W	Minimal value of the 15 minutes' mean active power
7088	7544	P_An_max	r	W	Maximal value of the 15 minutes' mean active power
7090	7545	U_An_min	r	W	Minimal value of the 10 minutes' mean voltage
7092	7546	U_An_max	r	W	Maximal value of the 10 minutes' mean voltage
7094	7547	F_An_min	r	Hz	Minimal value of the 10 seconds' mean frequency
7096	7548	F_An_max	r	Hz	Maximal value of the 10 seconds' mean frequency

[1] *In case of registers no occuring in the given series of meters, their value is equal 1E+20*

Caution!

At the moment of the upper or lower range exceeding, parameters „Displayed value' „minimum', „maximum" are set up on 1 E+20.

Description of the status register


Kind of display
Compensation error of lead resistance
Kind of output (voltage, current)
Working mode and information unit
Baud rate
Position of the decimal piont
Signalling of the upper range overrunning
Signalling of the lower range overrunning
Relay state (alarm) 2
Relay state (alarm) 1
Individual characteristic or lack of it
X X X X X X X X X X X X X X X X
bits 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
MSB
LSB

Bit-15 Kind of display

0 - meter with a 4-digit display

1 - meter with a 5-digit display

Bit-14 Compensation error of the lead resistance

0 - lack of error

1 - signalling a compensation error

Caution!

This bit is only set in the N12T meter. For other types of N12 meter executions, the value of this bit is optional.

Bit-13 Kind of output (voltage, current)

0 - current

1 - voltage

Bit-12...10 Working mode and information unit

000 - interface switched off
001 - 8N1 - ASCII
010 - 7E1 - ASCII
011 - 7O1 - ASCII
100 - 8N2 - RTU
101 - 8E1 - RTU
110 - 8O1 - RTU

Bit-8...9 Baud rate

00 - 2400 bit/s
01 - 4800 bit/s
10 - 9600 bit/s

Bit-5...7 Position of the decimal point

000 - lack
001 - 0.0
010 - 0.00
011 - 0.000
100 - 0.0000 (only for 5-digit meter executions)

Bit-4 Signalling of the range upper overrunning

0 - normal work
1 - range overrunning

Bit-3 Signalling of the range lower overrunning

0 - normal work
1 - range overrunning

Bit-2 Relay state (alarm 2)

0 - switched off
1 - switched on

Bit-1 Relay state (alarm 1)

0 - switched off
1 - switched on

Bit-0 Individual charakteristic

0 - Individual charakteristic switched off
1 - Individual charakteristic switched on

8. TECHNICAL DATA

Panel meter dimensions	96 × 48 × 93 mm
Protection index ensured by the housing	IP 65
Protection index ensured from the terminal side	IP 20

Rated operating conditions:

• supply voltage depended on the execution code	85...230...253 V a.c. d.c. 20...24...40 V a.c. d.c.
• supply voltage frequency	40...50...440 Hz
• ambient temperature	-20...23...50^{0}C
• air relative humidity	< 95% (water vapour condensation inadmissible)
Power consumption	max 7 VA
Storage temperature	-20...+85^{0}C

Display field:

N12P4	four 7-segment LED displays and two alarm diodes
N12P5	five 7-segment LED displays, two alarm diodes, and two diodes for the unit highlighting

Indication range of the digital display:

N12P4	-1999...9999
N12P5	-19999...99999
Servicing	four keys

Relay outputs

- programmable alarm thresholds,
- three types of alarms (see chapter 6),
- hysteresis defined by means of the lower and upper alarm threshold,
- signalling of alarm action by means of diodes,
- programmable delay of the alarm operation,
- two relay outputs,
- voltageless make contacts - maximal load capacity:
  - voltage: 250 V a.c., 150 V d.c.
  - current: 5 A 30 V d.c., 250 V a.c.
  - resistance load: 1250 VA, 150 W

Analogue output

- current programmable 0/4...20 mA - load resistance $\leq 500\ \Omega$,
- voltage programmable 0...10 V - load resistance $\geq 500\ \Omega$,
- galvanic insulation,
- resolution 0.01% of the range,
- basic error $\pm$ (0.1 % i.v.+ 0.2% u.l.)[2].

Digital output

- RS-485 interface ,
- MODBUS transmission protocol:
  - ASCII: 8N1, 7E1, 7O1
  - RTU: 8N2, 8E1, 8O1,
- Baud rate: 2400, 4800, 9600 bauds,
- Maximal response time for query frame: 300 ms

Fastness against supply decays acc. EN 61000-6-2:2002

Electromagnetic compatibility:

- immunity acc. EN 61000-6-2:2002
- emission acc. EN 61000-6-4:2002

[2] i.v. - indicated value
u.l.- upper limit of the measuring subrange

Safety requirements:

according IEC 61010-1 standard:

- installation category III
- level of polution 2
- maximal voltage in relation to the earth 600 V a.c.

Parameters of the meter:

- prolonget overrunning of the upper range 20%

Kind of input	Rated indication range		Basic error
	5 digits	4 digits	
Rms voltage	1...100.0	1...100.0	±(0.1% i.v. + 0.2 % u.l.)[2]
Rms voltage	4...400.0	4...400.0	±(0.1% i.v. + 0.2 % u.l.)
Rms current	0.01...1.000	0.01...1.000	±(0.1% i.v. + 0.2 % u.l.)
Rms current	0.05...5.000	0.05...5.000	±(0.1% i.v. + 0.2 % u.l.)
Frequency	10.00...100.00	10.00...99.99	±(0.1% i.v. + 0.1 % u.l.)
Active power	-19999...99999	-1999...9999	±(0.1% i.v. + 0.5 % u.l.)
Reactive power	-19999...99999	-1999...9999	±(0.1% i.v. + 0.5 % u.l.)
Apparent power	-19999...99999	-1999...9999	±(0.1% i.v. + 0.5 % u.l.)
Power factor	-1.000...1.000	-1.000...1.000	±(0.1% i.v. + 1% u.l.)[3]
Ratio of reactive power to the active power	-100.0...100.0	-100.0...100.0	±(0.1% i.v. + 1% u.l.)[3]
Angle phase	0...359.9	0...359.9	±(0.1% i.v. + 1% u.l.)[3]
Active energy	-19999...99999	-1999...9999	±(0.1% i.v. + 0.5% u.l.)
Reactive energy	-19999...99999	-1999...9999	±(0.1% i.v. + 0.5% u.l.)
Apparent energy	-19999...99999	-1999...9999	±(0.1% i.v. + 0.5% u.l.)
15 minutes' active power	-19999...99999	-1999...9999	±(0.1% i.v. + 0.5% u.l.)
10 minutes' voltage	1...100.0	1...100.0	±(0.1% i.v. + 0.2% u.l.)
10 minutes' voltage	4...400.0	4...400.0	±(0.1% i.v. + 0.2% u.l.)
10 seconds' frequency	10.00...100.00	10.00...99.99	±(0.1% i.v. + 0.1% u.l.)
Current time	0.00...23.59	0.00...23.59	1 second/24 hours

[2] i.v. - indicated value
u.l. - upper limit of the measuring sub range

[3] error in the range 10...20% of the I or U range

Measurement of the rms a.c. voltage

The voltage value is calculated according the formula:

$$U_{sk} = trU \bullet \sqrt{\frac{1}{n}\sum_{i=1}^{n} u_i^2}$$

Basic error in reference conditions:

±(0.1% i.v. + 0.2% u.l.)

Calculation of the mean value in the walking period of time:

$$U_{srsk} = \frac{1}{n}\sum_{i=1}^{n} U_{SK_1}$$

Where: *n* - averaging time in seconds
Usk - real rms value in the voltage period
Usrsk - mean value changing in the time of the rms voltage value

Basic error:

±(0.1% i.v. + 0.2% u.l.)

Calculation of the 10 minutes' voltage

$$U_{śr} = \frac{1}{n}\sum_{i=1}^{10} U_{sk_i}$$

Basic error:

±(0.1% i.v. + 0.2% u.l.)

Measurement of the real rms a.c. current

The value of the current is calculated according the formula

$$I_{sk} = trI \bullet \sqrt{\frac{1}{n}\sum_{i=1}^{n} i_i^2}$$

Where: *trI* - ratio of the current transformer
n - number of samples in the period or in the multiple of the measured current period
i - actual value of the current

Basic error in reference conditions:

±(0.1% i.v. + 0.2% u.l.)

Calculation of the mean value in the walking period of time:

$$I_{srsk} = \frac{1}{n}\sum_{i=1}^{n} I_{SK_1}$$

Where: *n* - averaging time in seconds
Isk - real rms value in the voltage period
Isrsk - mean value changing in the time of the rms current value

Basic error:

±(0.1% i.v. + 0.2% u.l.)

Measurement of the a.c. active power

The active power of the distorted current is calculated according the formula:

$$P = trU \bullet trI \bullet \frac{1}{n}\sum_{i=1}^{n} u_i \cdot i_i$$

Where: *trU* - ratio of the voltage transformer
trI - ratio of the current transformer
n - number of samples in the period or in the multiple of the measured current period
u - actual value of voltage
i - actual value of current

Basic error in reference conditions:

±(0.1% i.v. + 0.5% u.l.)

Calculation of the mean value in the walking period of time

$$P_{sr} = \frac{1}{n}\sum_{i=1}^{n} P_i$$

Where: *n* - averaging time in seconds
Pi - value of the active power in the period of the measured signal
Psr - mean value changing in the time of the active power value

Basic error:

±(0.1% i.v. + 0.5% u.l.)

Calculation of the active power energy

$$E_p = \frac{1}{n}\sum_{i=1}^{n} aP_i$$

Basic error:

±(0.1% i.v. + 0.5% u.l.)

Measurement of the a.c. apparent power

The apparent power is calculated according the formula:

$$S = trU \bullet trI \bullet U_{SK} \bullet I_{SK}$$

Where: *trU* - ratio of the voltage transformer
trI - ratio of the current transformer
Usk - real rms value of the voltage
Isk - real rms value of the current

Basic error in reference conditions:

±(0.1% i.v. + 0.5% u.l.)

Counting of the apparent power energy:

$$E_S = \frac{1}{n}\sum_{i=1}^{n} aS_i$$

Basic error:

±(0.1% i.v. + 0.5% u.l.)

Measurement of a.c. reactive power

The reactive power is calculated according the formula:

Where: *trU* - ratio of the voltage transformer
trI - ratio of the current transformer
S - apparent power
P - active power

$$Q = trU \bullet trI \bullet sign\left(\sqrt{S^2 - P^2}\right)$$

Basic error in reference conditions:

±(0.1% i.v. + 0.5% u.l.)

Counting of the reactive power energy:

$$E_Q = \frac{1}{n}\sum_{i=1}^{n} aQ_i$$

Basic error:

±(0.1% i.v. + 0.5% u.l.)

Measurement of the a.c. power factor - cosφ

The power factor is calculated according the formula:

$$\cos\varphi = \frac{P}{S}$$

Where: *P* - active power
S - apparent power

Basic error in reference conditions:

±(0.1% i.v. + 1% u.l.)

Measurement of the ratio of the reactive power to the active power - tgφ

The ratio of the reactive power to the active power is calculated according the formula:

$$\text{tg}\,\varphi = \frac{Q}{P}$$

Where: *Q* - reactive power
P - active power

Basic error in reference conditions:

±(0.1% i.v. + 1% u.l.)

Measurement of the a.c. voltage frequency

The frequency of the voltage is calculated according the formula:

$$f = \frac{1}{T}$$

Where: *T* - period of a.c. voltage
f - frequency (current value of one period)

Basic error in reference conditions:

±(0.1% i.v. + 0.1% u.l.)

Calculation of the 10 seconds' frequency:

$$f_{śr} = \frac{1}{n}\sum_{i=1}^{n} f_i$$

Where: *n* - averaging time in seconds
fi - frequency value in the period of the measured signal
fsr - mean value changing in the time of the frequency value

Basic error:

±(0.1% i.v. + 0.1% u.l.)

Preheating time	15 minutes
Weight	200 g
Repetition time of the measurement	programmable, min. 500 ms

9. BEFORE A FAILURE WILL BE DECLARED

SYMPTOMS	PROCEDURE
1. The meter does not operate	Check the connection of the feeder cable
2. Only the diodes are lighting	Number of measurements = 0 has been introduced. The meter operates in the SLEEP mode - the display is blanked.
3. Only the horizontal dashes are displayed	Check the correctness of the input signal connection. See in the service manual.
4. Only the inscription **noC** is displayed	The meter is discalibrated, Contact the nearest authorized service workshop.
5. Lack of possibility to enter into the programming mode. The inscription **ErrC** is displayed.	The programming mode is protected by the password. If the user forgets which password has been introduced one must contact the nearest authorized service workshop.
6. Lack of certainty if all display segments are efficient	Enter into the service mode and switch on the display test. Simultaneously the same segments should be lighted on all displays. The state with blanked displays does never occur. Otherwise, submit the defect to the nearest authorized service workshop.

7. During the operation in the programming mode, parameter values inconsistent with the range of changes given in the table 1, appear on the display	Enter into the service mode and accept the **SEt** parameter. The meter will introduce values in accordance with the table 2.
8. A result inconsistent with our expectations occurs on the display.	Check if the individual characteristic is not switched on. In case of necessity, enter into the service mode and accept the **SEt** parameter. The meter will introduce parameters in accordance with the table 2.
9. **H1**, **Y1**, **H2**, **Y2, d_P** parameter symbols are not displayed in the programming mode.	In case of switched individual characteristic off, mentioned symbols are omitted.
10. Despite of the alarm threshold exceeding, neither the alarm relay nor the signalling diode is switched on.	Check the introduced delay of the alarm operations into the meter. If need be, correct the **dLY** parameter.
11. Despite of the relay switching off, the alarm diode does not go out.	Check if the alarm signalling support is not switched on. **LEd** parameter off. In case of need, switch it off.
12. When the parameter of the alarm signalling support is switched on, lack of possibility to erase the signalling diode by means of the key combination. (Fig. 4.).	The alarm still lasts. The erased diode is immediately re-lighted.
13. Despite the fact that the alarm still remains, the signalling diod does not light up.	Check if a delay of the alarm operation has not been introduced. **dLY** parameter
14. Instead to display the measurement result, the meter displays the parameter symbol alternately with its value despite we were not entered into the programming mode.	The meter works in the monitoring mode.

15. A delay of the alarm operation has been introduced, e.g. 30 measurements, however after this time the alarm has not operate.	The lasting alarm state was shorter than the programmed, e.g. during the lasting time of the alarm the state of alarm withdrawal occurs. In that case the meter begins counting the measurements from the beginning.
16. The meter does not establish a communication with the computer.	Check whether leads of interface (**A**, **B**, **GND**) were correctly connected. Then, check the setting of the interface (**trYb**, **bAud**, **Adr**) in the programming matrix. These parameters must be the same as in the used software.

10. PROGRAMMING EXAMPLES OF N12 METERS

Example 1 - Programming of an individual characteristic.

If we want to programme so that to the value 0.0 V will correspond the value 0 on the display, whereas to the value 400.0 V will correspond the value 10000, one must:

- choose as the type of the input quantity, the measurement of the voltage **U**,
- chose the **Ind** parameter, and switch the individual characteristic on,
- chose the parameter **H1** and introduce the value 0.0,
- pass on the **Y1** parameter and introduce the value 0,
- pass on the **H2** parameter and introduce the value 400.0,
- pass on the **Y2** parameter and introduce the value 10000,
- pass on the **d_P** parameter and set the point on 00000.

Example 2 - Programming of an inverse individual characteristic.

If we want to programme so that to the value 5.000 A will correspond the value 0.00 on the display, whereas to the value 0.000 A will correspond the value 100.00, one must:

- choose as the type of the input quantity the measurement of the current I,
- choose the **Ind** parameter and switch the individual characteristic on,
- choose the **H1** parameter and introduce the value 0.000,
- pass on the **Y1** parameter and introduce the value 100.00,
- pass on the **H2** parameter and introduce the value 5.000,
- pass on the **Y2** parameter and introduce the value 0.00,
- pass on the **d_P** parameter and set the decimal point on the position 000.00.

Example 3 - Programming of the alarm with hysteresis

If we want to programme the alarm 1 operation so that the alarm will be switched on at the value 400.0 V, whereas switched off at the value 100.0 V, and the alarm 2 so that at the value 5.000 A the alarm will be switched off and switched on at the value 1.000 A, one must:

- enter into the programming mode and choose the level with the **ALr1** symbol,
- pass on the **P_A1** parameter and set U,
- pass on the **PrL1** parameter and introduce the value 100.0,
- pass on the **PrH1** parameter and introduce the value 400.0
- pass on the **tYP1** parameter and choose the function designed as **nor**,
- exit from the **ALr1** level and pass on the **ALr2** level,
- pass on the **P_A2** parameter and introduce I,
- choose the **PrL2** parameter and introduce the value 5.000,
- pass on the **PrH2** parameter and introduce the value 1.000,
- pass on the **tYP2** parameter and choose the function **nor**.

Example 4 - Programming of an alarm operating in the given interval with delay.

If we want that the alarm 1 will be switched on in the interval from 100.0 V up to 300.0 V and operated only after 10 sec, one must:

- enter into the programming mode and choose the **ALr1** level,
- pass on the **P_A1** parameter and set **U**,
- pass on the **PrL1** parameter and introduce the value 100.0,
- pass on the **PrH1** parameter and introduce the value 300.0,
- pass on the **tYP1** parameter and choose the On function,
- pass on the **dLY1** parameter and set 10 if **UAL=2** , in the contrary **dLY = 10/**(**UAL x 0.5s**),
- exit from the programming mode.

In case of the alarm state duration for a time longer than 10 sec., the meter will switch the alarm relay on and the alarm diode will be lighted.

Example 5 - Programming of the analogue output

If we want to program so that to the 0.000 A value will correspond the 4 mA value on the current analogue output, whereas to the 5.000 A value will correspond the 20 mA value, one must:

- enter into the programming mode. Pass on the **P_An** parameter and choose the current **I** as the type of the input quantity,
- pass on the **tYPA** parameter responsible for the analogue output type. Choose the **PrAd** current output.
- under the **AnL** parameter, one must write down the value of the input signal for which we want 0 mA on the analogue output. For this reason one must calculate the **AnL** parameter:

  (5.000-0.000)/(20.00-4.00) = 0.3125 => 0.000 - (4.00 x 0.3125) = -1.250
- choose the **AnL** parameter and introduce the value - 1.250
- choose the **AnH** parameter and introduce the value 5.000

11. EXECUTION CODES

N12 METER	X	X	X	X	X	XX	X	XXX

Input

temperature, programmable input	**T**
1 V d.c., 10 V d.c., 20 mA d.c, 200 mA d.c.	**S**
600 V d.c. , 1 A d.c. , 5 A d.c.	**H**
revolutions, frequency, period, pulses	**O**
single-phase network parameters	**P**
indicator for synoptic panels	**B**
on order	**X**

unit symbol *)

Number of display

4 x 20 mm high digits	**4**
5 x 14 mm high digits + unit	**5**

Display colour

Red	**0**
Green	**1**

Supply voltage

230 V a.c. d.c.	**1**
24 V a.c. d.c.	**2**

Kind of terminals

Socked-plug with screw connections	**0**
Socked-plug with self-locking connections	**1**

Execution

standard	**00**
custom-made	**XX**

Acceptance tests

Without a quality acceptance certificate	**0**
With a quality inspection certificate	**1**
acc. customer's agreement	**X**

*) Introduce the unit symbol

Order example: N12P-5-0-1-0-00-0-kW means: a N12P digital meter of single-phase network parameters , with 5 displays in red colour, voltage supply: 230 V a.c., d.c., kind of terminal: socket-plug with screw connection, standard execution, without a quality acceptance certificate, with the highlighted kW unit.

In case of a custom-made execution or need of more detailed technical information please contact our Export Department.

In case of any meter failure one must contact the nearest authorized service workshop.

12. MAINTENANCE AND GUARANTEE

The N12P meter does not require any periodical maintenance. In case of some incorrect unit operations:

1. In the period of 12 months from the date of purchase:

One should take the meter down from the installation and return to the Manufacturer's Quality Control Dept.
If the unit has been used in compliance with the instructions, the manufacturer guarantees to repair it free of charge.

2. After the guarantee period:

One should turn over the meter to repair in a certified service workshop.
The disassembling of the housing causes the cancellation of the granted guarantee.
Spare parts are available for the period of ten years from the date of purchase.

We reserves the right to make changes in design and specifications of any products as engineering advances or necessity requires.

SALES PROGRAMME

MEASUREMENT
CONTROL
RECORDING

- DIGITAL PANEL METERS
- BARGRAPH INDICATORS
- MEASURING TRANSDUCERS
- ANALOGUE PANEL METERS (DIN INSTRUMENTS)
- DIGITAL CLAMP-ON METERS
- PROCESS and HOUSEHOLD CONTROLLERS
- CHART and SCREEN RECORDERS
- POWER CONTROL UNITS and FREQUENCY INVERTERS
- AUTOMOTIVE DASHBOARD INDICATORS
- STATIONARY and PORTABLE CALIBRATORS
- MEASUREMENT ACCESSORIES (SHUNTS, SENSORS, TRANSFORMERS)
- MEASURING SYSTEMS (ENERGY, HEAT, CONTROL, MEASUREMENT)
- CUSTOM-MADE PRODUCTS

WE ALSO OFFER OUR SERVICES IN THE PRODUCTION OF:

- ALUMINIUM ALLOY PRESSURE CASTINGS
- PRESSURE CASTING DIES AND INJECTION MOULDS
- PRECISION ENGINEERING AND THERMOPLASTICS PARTS

QUALITY PROCEDURES:

According ISO 9001 international requirements.

LUMEL

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